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(71) Applicant: **KOMATSU LTD.**
Minato-ku, Tokyo 107-8414 (JP)

(72) Inventors:
- **Nagatsuka, Isao**
  Kawagoe-shi, Saitama-ken 350-1192 (JP)
- **Endou, Takeshi**
  Kawagoe-shi, Saitama-ken 350-1192 (JP)
- **Mimuro, Junji**
  Kawagoe-shi, Saitama-ken 350-1192 (JP)
- **Tanaka, Hirofumi**
  Kawagoe-shi, Saitama-ken 350-1192 (JP)

(74) Representative: **Ilgart, Jean-Christophe et al**
c/o Société de Protection des Inventions,
3, rue du Docteur Lancereaux
75008 Paris (FR)

(54) Loader apparatus

(57) A boom mechanism for a loader apparatus having a frame with a front and rear end and an engine mounted at the rear end. A main boom has a first and second section which telescope with each other and is pivotally mounted on the frame of the loader apparatus. A hydraulic cylinder is connected to the first and second sections for changing the length of the main boom. A bucket is pivotally mounted on a free end of the second section of the main boom so that the main boom may be pivoted and telescoped and the bucket may be pivoted to a desired angle and position for loading and unloading.

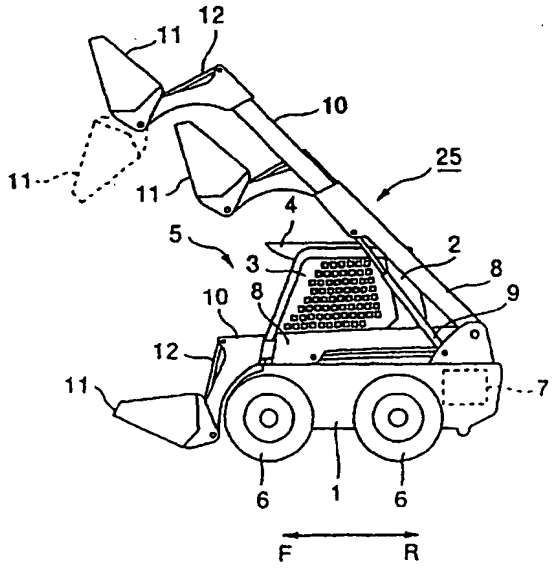

Figure 1

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Description

[0001] The present invention relates to a loader such as a skid steer loader, etc. More particularly, the present invention relates to a stable, rear end engine mounted loader apparatus having a new and improved boom mechanism and loading and unloading means.

Background of the Invention

[0002] Conventionally, a skid steer loader capable of raising a bucket vertically in order to perform a smooth loading job is known described in, for example, Japanese Kokai Patent application No. Hei 6[1994]-26068. Figure 9 of the present application shows a side view of the skid steer loader disclosed in such application. The prior art will be explained below based on Figure 9.

[0003] In this figure, the skid steer loader has a second lift boom part 102 by which the lift boom base is coupled to a main frame 101 to oscillate freely. The base of a main lift boom 103 is coupled to the extreme end of the second lift boom 102 to oscillate freely. Bucket 104, which is the loading and unloading means of the loader, is mounted on the extreme end of main lift boom 103, which lengthens when bent downward, to oscillate freely. Bucket 104 oscillates freely in response to the extension of at extendable actuator 105.

[0004] An approximately T-shaped control arm 106 is fixed at the middle of main lift boom 103. The extreme end of a control link 107 of prescribed length is mounted on the extreme end of control arm 106 to oscillate freely. The base end of control link 107 is mounted on the main frame 101 to oscillate freely. Also, the extreme end of an extendable cylinder assembly 108 is attached to control arm 106. The base end of assembly 108 is attached to main frame 101 to respectively oscillate freely.

[0005] When the cylinder assembly 108 is extended or retracted the bucket 104 is raised or lowered according to this type of construction, the path 109 (shown dotted) of the extreme end of main lift boom 103 is an arc shaped path from the lowermost position to a specific height H, and is a vertical path from this height H to the highest lift height, as shown in the aforementioned Figure 9.

[0006] However, there are problems, described below, in the prior art disclosed in the aforementioned Japanese Kokai Patent Application No. Hei 6[1994]-26068.

[0007] According to the illustrated prior art, the second lift boom part 102 is interposed between the main frame 101 and the main lift boom 103 in order to make the path 109 of the extreme end of the main lift boom 103 vertical. Consequently, the number of joints in the boom is increased. This leads to much unsteadiness of the center of oscillation in the boom after long use. Thus, the movement of the main lift boom 103 is no longer smooth. Also, it is necessary to constantly grease the joints of the boom in order to prevent this type of unsteadiness, and the time necessary for maintenance and inspection increases. Thus, the availability time for the equipment decreases.

[0008] Furthermore, the control arm 106 is arranged beside the driver's seat, therefore, the field of view beside the worker is blocked by the control arm 106 when the main lift boom 103 is raised or lowered. This makes it difficult for the loading and unloading to be performed properly.

[0009] Also, with the increase in loading work in confined spaces in recent years, a skid steer loader is required which is capable of more readily changing the path of the bucket 104 to correspond with the position of materials handling equipment such as a dump truck, etc. However, according to the prior art, the path of the extreme end of the main lift boom 103 namely, the path of bucket 104 is always fixed, which is a problem.

Summary of the Invention

[0010] The present invention was made by focusing on the aforementioned problems, and has as an object to provide a loader which changes the path of the bucket as desired and which has minimal unsteadiness of the boom.

[0011] A second object of the present invention is to provide a boom mechanism in a loader apparatus having a frame with a front and rear end and an engine mounted at the rear end. The boom mechanism includes a main boom having at least a first and second section. The first section is pivotally mounted on the frame substantially at the rear end thereof. The second section is slideably mounted on said first section so that the sections telescope with each other and the second section has a free end. A moving member is provided for moving the second section with respect to the first section to vary the length of the main boom. Finally, loading and unloading means are pivotally mounted on the free end of the second section whereby the main boom may be pivoted and telescoped to move the loading and unloading means along a path to a desired position and such means may be pivoted to a desired angle for loading and unloading.

[0012] In a further embodiment, the moving member is a telescoping cylinder mounted on the first and second sections of the main boom.

[0013] In still a further embodiment, the cylinder is a hydraulically operated cylinder.

[0014] The loading and unloading means may be a bucket pivotally mounted on the free end of the second section.

[0015] In another preferred embodiment, the main boom has a pair of first sections respectively telescoping with a pair of second sections. In addition, spacing means for maintaining the pair of first sections and the pair of second sections a predetermined distance apart and wherein the moving member moves said pairs of sections simultaneously.

[0016] In yet a further preferred embodiment, the

main boom may be pivoted through several inclination angles with respect to the frame. The boom mechanism also includes a boom angle sensor for detecting the inclination angle of the main boom and producing an output signal indicating such angle. Finally, a controller is included responsive to the output signal for controlling the path of the loading and unloading means.

[0017] In an improved embodiment a plurality of sensors are provided for producing respective output signals related to the relative positions of the main boom, the frame and the loading and unloading means. A controller responsive to the plurality of output signals automatically controls the path of movement of the loading and unloading means.

[0018] In a further improved embodiment, the plurality of sensors include a boom angle sensor which detects the angle of inclination between the main boom and the frame and produces a first output signal. A stroke sensor detects the amount of stroke by which the second section of the main boom extends from the first section and produces a second output signal. Finally, a loading and unloading means sensor detects the inclination angle between this means and the second section of the main boom and produces a third output signal. The controller is responsive to the first, second and third output signals and controls the path which the loading and unloading means must follow based on the detected values.

[0019] Also, a desired bucket path, such a movement horizontally in addition to vertically, can be obtained and the path can be changed according to the positional relationship of the obstacle and the materials handling equipment or according to the job requirements, and loading can be executed efficiently.

[0020] Moreover, the number of boom joints are not increased, as required in the prior art, to obtain this type of bucket path, so maintenance such as greasing, etc., of the boom joints becomes unnecessary, and unsteadiness of the boom is also minimized.

[0021] Also, for example, if the boom is composed so that the telescoping cylinder can be accommodated inside the main boom, the oil seal is not contaminated by dirt and sand falling on the telescoping cylinder, and the telescoping cylinder will remain in good condition.

[0022] Furthermore, the boom dies not have a structure that obstructs the field of view beside the driver's seat, so the field of view is wide and work performance is good.

Brief Description Of The Drawings

[0023] Other features and advantages of the present invention will be understood from the following detailed description of the preferred embodiments made with reference to the appended drawings, in which:

Figure 1 is a side.view of a skid steer loader according to an embodiment of the present invention;

Figure 2 is a perspective view of the boom portion of Figure 1;

Figure 3 is a cross section of the boom shown in Figure 2.

Figure 4 is a block diagram of the sensors and the controller used to control movement of the boom and bucket;

Figure 5 is a side view showing an example of the pat of the bucket;

Figure 6 is a side view showing an example of a further path of the bucket;

Figure 7 is a side view showing an example of still another path of the bucket possible within the preferred embodiment;

Figure 8 is a perspective view of an operating lever for the loader; and

Figure 9 is a side view of a prior art skid steer loader.

Description of the Preferred Embodiment

[0024] Below, an embodiment according to the principles of the present invention will be explained in detail with reference to the figures. In the embodiment, the elements identical to those in Figure 9 are given the same numerals, and duplicate explanation is omitted.

[0025] Figure 1 shows a side view of a skid steer loader according to a preferred embodiment of the present invention. The traveling direction of the skid steer loader indicated by arrow F (front) - R (rear) at the bottom of this figure will be referred to as the longitudinal direction. The width direction of the vehicle which crosses this longitudinal direction will be referred to as the lateral direction, and left and right in the lateral direction will be determined according to the direction perceived by a worker seated in the driver's seat facing forward.

[0026] In Figure 1, the skid steer loader is provided with drive motor frame 1 and is provided, respectively with wheels 6 and 6 at the bottom part thereof, engine 7 at the inside rear part thereof, and boom 25 at the top part thereof. A pair of left and right pillars 2 are erected on the top part at the rear of drive motor frame 1, and protective screens 3 and 3 which have many holes are respectively erected at both the left and right sides in front of pillars 2. Then, roof 4 is provided across the top part of the left and right protective screens 3 and 3 and a driver's cab 5, with the front having an opening for the operator to enter.

[0027] The main boom 25 is provided with a hollow first section 8 and a hollow telescoping second section 10. The base of first section 8 is pivotally mounted bode engine 7 at the rear of drive motor frame 1 to oscillate

freely. This first section 8 is moved vertically according to the extension of a main cylinder 9, which is mounted at the base to the drive motor frame 1 and at its extreme end to the middle of main boom 8, respectively.

[0028] Telescoping boom second section 10 is inserted inside main boom first section 8 to slide freely. Bucket 11, which is the loading and unloading means in this embodiment, is pivotally mounted at the extreme end of telescoping boom 10 to oscillate freely and is oscillated by means of a bucket cylinder 12.

[0029] A perspective view of boom 25 is shown in figure 2 and a top cross section of boom 25 is shown in Figure 3. As indicated in both figures, boom 25 is provided with main boom first section 8, telescoping boom second section 10, and telescoping cylinder 16.

[0030] In main boom section 8, square columnar shaped bracket 13 and 13 made of steel are inserted into square tubing 14 and 14 and are mutually fixed by a round pipe 15 by means of, for example, welding, etc., by positions these first sections horizontally at a prescribed spacing. Also, telescoping boom section 10 is constituted by horizontally opposing square tubing 27 and 27 in which the extreme ends are bend downwardly at a prescribed spacing and mutually fixed by round pipe 26.

[0031] Telescoping cylinder 16 is inserted into the inside part of main boom section 8 and the cylinder base thereof is fixed to the internal wall of section 8. Also, the extreme end of the piston of telescoping cylinder 16 is fixed to the wall of telescoping boom second section 10 which is inserted inside of main boom 8 to slide freely. Consequently, telescoping boom section 10 slides inside of boom section 8 by the extension of telescoping cylinder 16. Thus, the extension and retraction of cylinder 16 moves section 10 respectively out from section 8 and back into section 8, as desired. The distance that section 10 extends out from Section 8 may be designated as the stroke distance.

[0032] At this time, the internal circumferential surfaces of the four sides of main boom section 8 are machined to smoothly correspond with the spacing of square tubing 27 of boom section 10. Consequently, the dimensional difference of the space between the brackets 13 and 13 of boom section 8 and the space between square tubing 27 and 27 of telescoping boom section 109 is compensated for and boom section 10 is made to slide smoothly in boom section 8.

[0033] Also, an operating lever (not shown in the figure) for operating boom section 8 and bucket 11 is provided inside driver's cab 5. By moving this operating lever forward and backward, the inclination angle of main boom 8 can be controlled. By moving the operating lever left and right, the inclination angle of bucket 11 can be controlled.

[0034] The skid steer loader shown in Figures 1-3 is provided with various sensors for detecting the length and angle of boom 25, and a controller which controls boom 25 based on these detected values. A block diagram of the sensors and controller provided on the skid steer loader is shown in Figure 4.

[0035] First of all, a boom angle sensor 18 which detects the inclination angle of boom section 8 with respect to the frame; is mounted at the center of oscillation of section 8,. As this boom angle sensor 18, for example, potentiometers, etc., are suitable.

[0036] Also, a stroke sensor 19 is integrated into telescoping cylinder 16 and detects the amount of stroke by which telescoping boom section 10 extends from section 8. Furthermore, bucket angle sensor 20 similar to boom angle sensor 18, is mounted at the center of oscillation of bucket 11 and detects the inclination angle of bucket 11 with respect to the horizontal.

[0037] These sensors are connected electrically to a controller 21 arranged inside drive motor frame 1 or inside driver's cab 5. Controller 21 receives the signals from these sensors and respectively measures the inclination angle of boom section 8, the amount of stroke of telescoping boom 10, and inclination angle of bucket 11.

[0038] Also operating lever sensor 33 for detecting the movement of operating lever, 32 is electrically connected to controller 21. Furthermore, mode switch 34, which specifies path 17, shown in Figures 6-8, to be followed by bucket 11, is connected to controller 21.

[0039] Controller 21 is electrically connected to electromagnetic control valves 29, 30 and 31 arranged at the bottom part of drive motor frame 1. Controller 21 controls the discharge pressure of electromagnetic control valve 29, 30, and 31 by sending electric signals to electromagnetic control valves 29 20 and 31 based on the detection signals of sensors 18, 19, and 20, the operation of operating lever 32, and the mode signal input from mode switch 34.

[0040] As the electromagnetic control valves, there are such examples as main boom control valve 29 which controls the inclination angle of main boom section 8 by driving main cylinder 9, telescoping boom control valve 30 which controls the extension of telescoping boom section 10 by driving telescoping cylinder 16, and bucket control valve 31 which controls the inclination angle of bucket 11 by driving bucket cylinder 12.

[0041] Electromagnetic control valves 29, 30, and 31 are respectively connected to the main valve not shown in the figure by means of hydraulic piping. The main valve outputs a pressure corresponding to the discharge pressures of electromagnetic control valves 29, 30, and 31, used as the control pressures and drives main cylinder 9, telescoping cylinder 16, and bucket cylinder 12.

[0042] By being constituted as described above, controller 21 can move bucket 11 so it follows the necessary path 17 according to the movement of operating lever 32. At the same time, controller 21 can execute control so that the inclination angle of bucket 11 is arranged at the desired angle.

[0043] Examples of path 17 of bucket 11 are shown in Figures 5-7. According to Figure 5, approximately an

arc path is followed by bucket 11 from the lowest position to a prescribed height (H) by ascending main boom section 8 with the length of boom 25 at its minimum without extending telescoping boom 10, as in the prior art. Then, from the height (H) to the highest lift height, boom 25 is extended by gradually extending telescoping boom section 10 so that bucket 11 follows approximately a vertical path 17.

[0044] This type of path 17 is suited for scooping earth and sand in bucket 11 by digging into a pile of earth and sand, etc. located in front, with bucket 11, and loading this into materials handling equipment. In other words, the path 17 of bucket 11 can follow an arc when digging into a pile of earth and sand so the digging force is strong and more earth and sand can be scooped into bucket 11. Therefore, the digging efficiency improves. Also, if control is executed at this time so that the open part of bucket 11 becomes approximately horizontal from height (H) to the highest lift height, loss of the material loaded in the bucket is minimal.

[0045] The case where bucket 11 follows a vertical path 17 from the lowest position to the highest lift height is shown in Figure 6. By controlling so that bucket 11 follows a vertical path, it is possible to load into the materials handling equipment without moving the skid steer loader too much away from when the load is loaded into bucket 11 at the lowest position. Therefore, the loading efficiency improves.

[0046] Also, by lower the inclination angle of main boom section 8 while extending telescoping boom section 10 after lifting the load to a prescribed height, bucket 11 can be extended in the horizontal direction as shown in Figure 7. For example, if there is an obstacle between the skid steer loader and the materials handling equipment and it is difficult for the skid steer loader to approach the materials handling equipment, loading into the materials handling equipment becomes possible by thus moving bucket 11 in the horizontal direction.

[0047] It is preferable for selection of these types of various paths 17 to be executed by the operator operating mode switch 34 to specify the path to controller 21. For example, the system may be set up to follow path 17 shown in Figure 5 by selecting number 1 with mode switch 34 and ascending main boom section 8: it may also be set up to follow path 17 shown in Figure 6 by selecting number 2. Thus, the worker can obtain the necessary path 17 by selecting a number with mode switch 34.

[0048] Also, whether the inclination angle of bucket 11 is to be controlled by controller 21 or by the operator with the operation of operating lever 32 can be selected at this time with mode switch 34.

[0049] It is also possible to obtain the desired path 17 by means of manual operation instead of controlling path 17 of bucket 11 with controller 21 as was described above. It is preferable for even this type of manual operation mode to be selected with mode switch 34.

[0050] An example of an operating lever enabling manual operation is shown in Figure 8. In this figure, toggle switch 35 is provided at the uppermost part of operating lever 32 and telescoping boom section 10 extends by telescoping cylinder 16 extending when this toggle switch 35 is pushed forward. Also telescoping boom section 10 retracts by telescoping cylinder 16 retracing when this toggle switch is pushed backward.

[0051] By the worker operating the aforementioned toggle switch 35 and operating lever 32 simultaneously the desired path 17 of bucket 11 can be obtained, in accordance with the surrounding situation.

[0052] As explained above, according to the illustrated embodiment, boom mechanism 25 which supports bucket 11 is constituted of hollow main boom first section 8 and telescoping boom second section 10 which slides on the inside thereof. The telescoping boom section 10 is made to extend from main boom 8 by means of telescoping cylinder 16. Consequently, it is possible to change the length of boom 25 as desired. Thus it is possible, for example, when bucket 11 has been lowered, to make path 17 at the extreme end of bucket 11 approximately vertical by making the boom the shortest at a slightly raised position and then gradually extending boom 25 while raising it further.

[0053] In other words, when loading material onto materials handling equipment such as a truck, etc., it is possible to bring bucket 11 even closer to the materials handling equipment than in a case when path 17 of bucket 11 is arc shaped without moving the skid steer loader, and loading can be performed efficiently.

[0054] Moreover, the number of joints in boom 25 is not increased in order to obtain this type of path 17 of bucket 11. Thus, maintenance such as greasing, etc., of the joints of boom 25 is minimized, and unsteadiness of boom 25 is minimized.

[0055] Also, path 17 of bucket 11 can be a desired path, for example, horizontal path, etc., in addition to a vertical path, so path 17 can be changed according to the positional relationship of obstacles and the materials handling equipment, and loading can be performed efficiently.

[0056] Telescoping cylinder 16 is accommodated inside main boom 8 so the oil seal is not contaminated by dirt and sand falling on telescoping cylinder 16, and telescoping cylinder 16 can be always be in working condition.

[0057] Also, the inclination angle of bucket 11 can be controlled to be the necessary angle so it is possible to prevent loaded material from falling out by controlling the angle according to the type of quantity of material loaded in bucket 11. As one example, control can be executed so that that the open part of the bucket remains horizontal when the bucket is above a specific height. Furthermore, it is possible to determine the inclination angle of bucket 11 so that the digging force increases during excavation, etc.

[0058] Furthermore, there is no structural member, as in the prior art, obstructing the field of view besides the

driver's cab 5 so the field of view is wide and the work performance is good.

[0059] Also, the inclination angle of main boom section 8 and the amount of stroke of telescoping, boom section 10 are detected and controller 21 controls path 17 of bucket 11 to be the required path based on these detected values. Consequently, path 17 of bucket 11 is automatically controlled base don a procedure programmed in controller 21 beforehand, so the burden on the worker is minimal, and moreover, an accurate path 17 can be obtained.

[0060] In the aforementioned embodiment, an explanation was given in which operation of cylinders 9, 16, and 12 is executed by discharging from a main valve corresponding to the control pressure discharged from electromagnetic control valves 29, 30 and 31, but it is not limited to this. For example, it is possible to operate cylinders 9, 16, and 12 by operating a solenoid installed at main valve 27 according to the electric signal output from controller 21.

[0061] Also, telescoping boom section 10 was shown inserted inside main boom section 8 to slide freely in the aforementioned embodiment. It is not restricted to this however and can be constructed so that main boom section 8 is installed inside telescoping boom section 10.

[0062] The invention has been described above in detail with respect to preferred embodiments. However, it is clear that various modifications can be carried out within the scope of the present invention which is defined by the following claims.

Claims

1. In a loader having a frame with a front and rear end and an engine mounted at said rear end, a boom mechanism characterized by:

   a main boom having at least a first and second section, said first section being pivotally mounted on said frame substantially at said rear end thereof, said second section being slideably mounted on said first section so that said sections telescope with each other and said second section has a free end;
   a moving member for moving said second section with respect to said first section to vary the length of said main boom; and
   loading and unloading means pivotally mounted on said free end of said second section whereby said main boom may be pivoted and telescoped to move said loading and unloading means along a path to a desired position and said means may be pivoted to a desired loading and unloading.

2. Apparatus as claimed in claim 1 characterized in that said moving member is a telescoping cylinder mounted on said first and second sections of said main boom.

3. Apparatus as claimed in claim 2 characterized in that said telescoping cylinder is mounted within said first section of said main boom.

4. Apparatus as claimed in claim 2 or 3 characterized in that said telescoping cylinder is a hydraulically operated cylinder.

5. Apparatus as claimed in any one of claims 1-4 characterized in that a second moving member is provided for moving said first section through different inclination angles with respect to said frame.

6. Apparatus as claimed in claim 5 characterized in that said second moving member is a hydraulically operated cylinder having one end connected to said frame and a second end connected to said first section of said main boom.

7. Apparatus as claimed in any one of claims 1-6 characterized in that said loading and unloading means is a bucket pivotally mounted on said free end of said second section.

8. Apparatus as claimed in any one of claims 1-7 characterized in that said second section slides inside of said first section to vary the length of said main boom.

9. Apparatus as claimed in any one of claims 1-8 characterized in that said main boom has a pair of first sections respectively telescoping with a pair of second sections; and spacing means for maintaining said pair of first sections and said pair of second sections a predetermined distance apart and wherein said moving member moves said pairs of sections simultaneously.

10. Apparatus as claimed in any one of claims 1-9 characterized in that said main boom may be pivoted through several inclination angles with respect to said frame and further comprising:

    a boom angle sensor for detecting said inclination angle of said main boom and producing an output signal indicating said angle; and
    a controller responsive to said output signal for controlling said path of said loading and unloading means.

11. Apparatus as claimed in any one of claims 1-9 characterized by a plurality of sensors

    producing respective output signals related to the relative positions of said main boom, said

frame and said loading and unloading means; and

a controller responsive to said plurality of output signals for automatically controlling the path of movement of said loading and unloading means.

12. Apparatus as claimed in claim 11 characterized in that said plurality of sensors include a boom angle sensor which detects the angle of inclination between said main boom and said frame and producing a first output signal;

a stroke sensor for detecting the amount of stroke by which said second section of said main boom extends from said first section and producing a second output signal; and

a loading and unloading means sensor which detects the inclination angle between said means and said second section of said main boom and produces a third output signal, wherein said controller is responsive to said first, second and third output signals and controls the path which said loading and unloading means must follow based on said detected values.

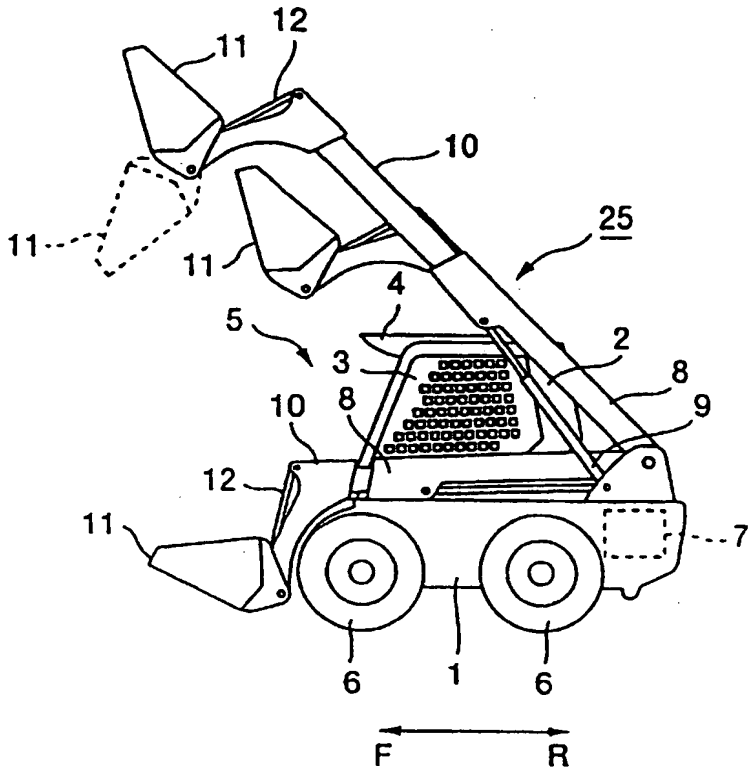

Figure 1

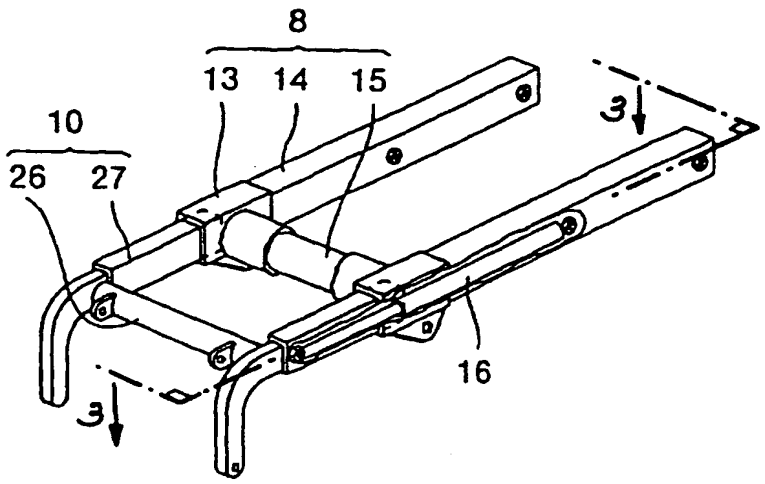

Figure 2

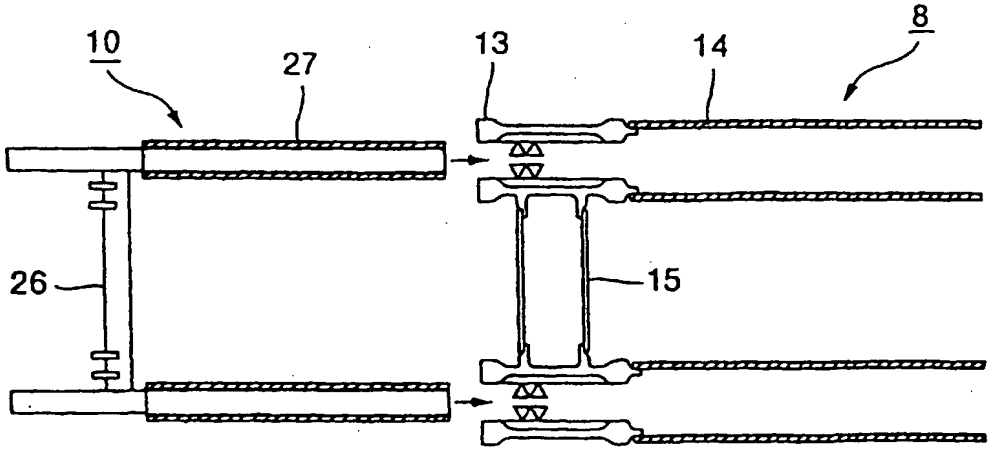

Figure 3

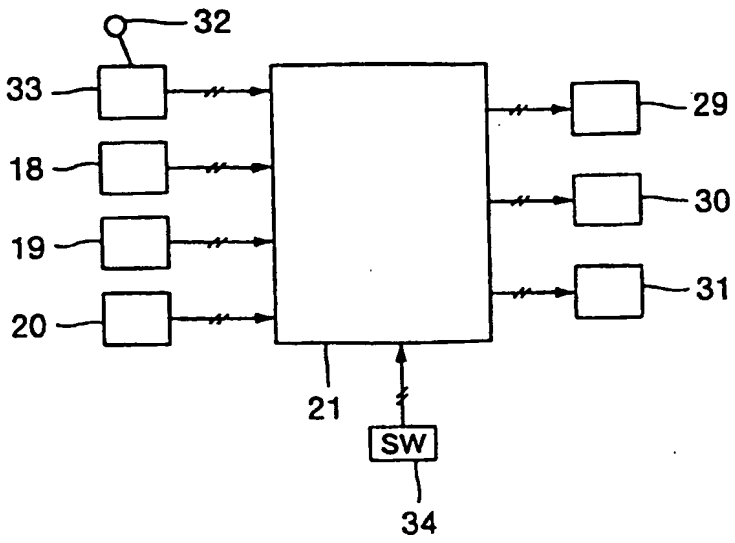

Figure 4

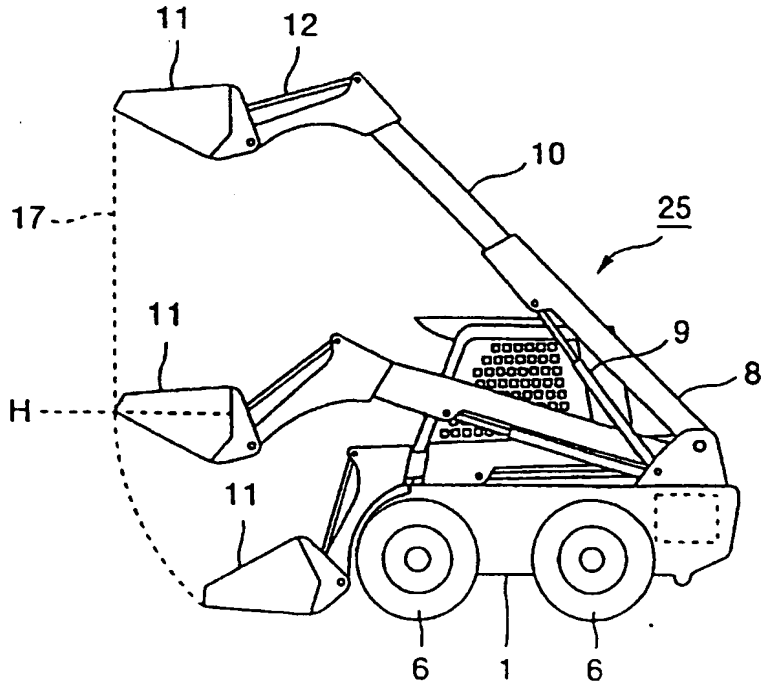

Figure 5

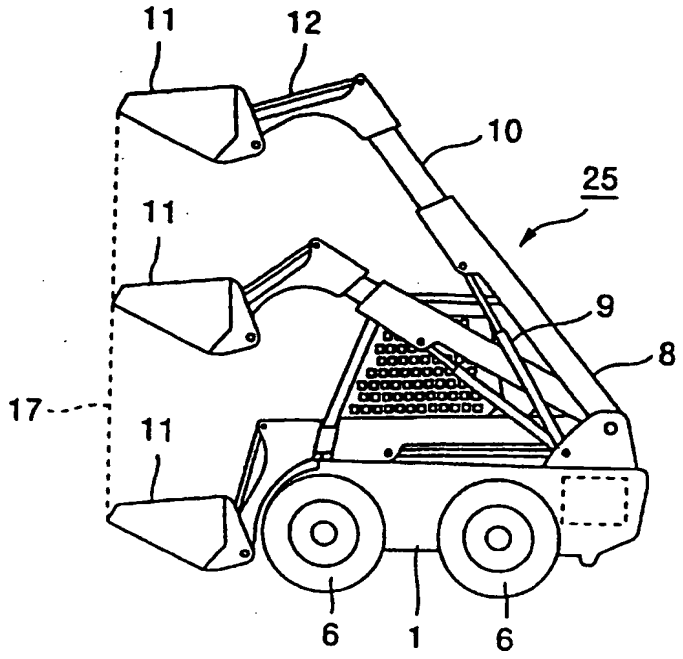

Figure 6

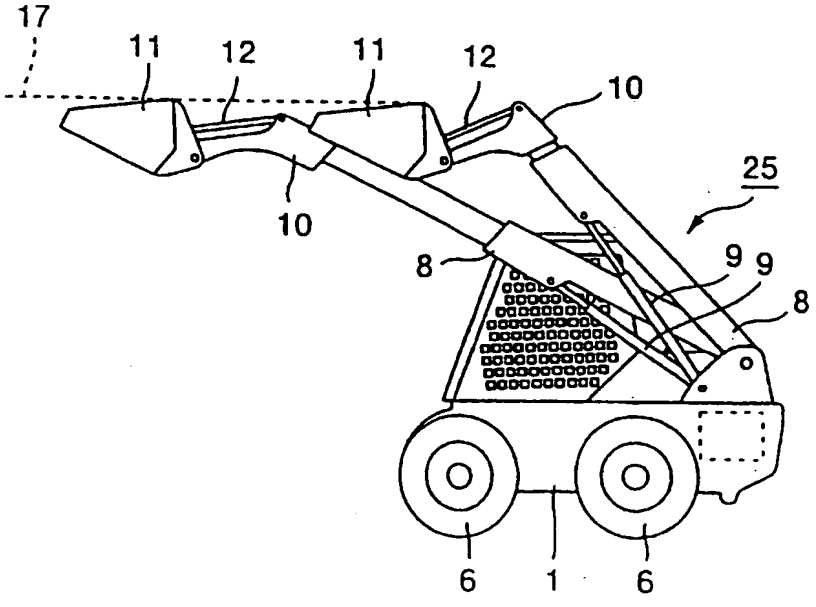

Figure 7

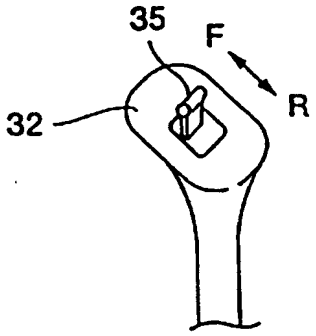

Figure 8

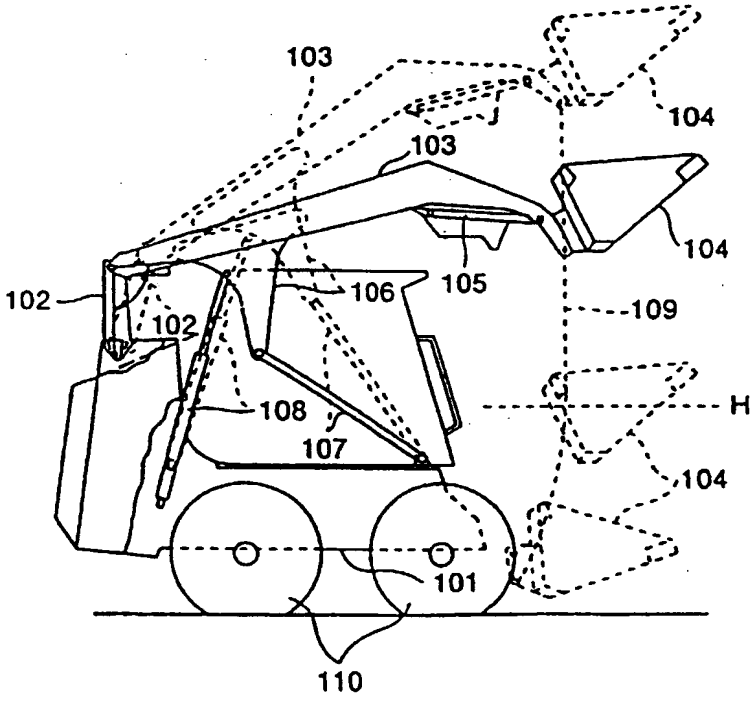

Figure 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 40 2368

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X A	FR 2 552 415 A (NOIROT) 29 March 1985 (1985-03-29) * figures 1-3 * * page 3, line 18 - line 31 * * page 4, line 10 - line 25 *	1-3,5,7, 8 4,6	E02F3/34 E02F3/43 E02F9/20
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X A	US 4 741 662 A (SCHMIESING GREGORY) 3 May 1988 (1988-05-03) * figures 4-6 * * column 6, line 53 - column 7, line 13 * * column 7, line 22 - line 33 * * column 9, line 63 - column 10, line 22 *	1,2,4-8 9	
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